FLOSWITCH

User manual *rel. 1.0*

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TABLE of CONTENTS

PREVIEW **4**

INSTALLATION **4**

Earth *4*
Backup battery *4*

KEYBOARD OPERATION **5**

MAINTENANCE 6
MANUAL SWITCH OVER 7
PROGRAMMING 7
System configuration *7*
Plant configuration *8*
Input Setup *10*
ERASING SETUP PARAMETERS 12

FUNCTIONS **12**

MONITORING 12
ALARMS MANAGEMENT 13
FAILS 14
SHUT-OFF 15
HALT 15

MOUNTING **16**

ELECTRICAL CONNECTIONS **17**

TYPICAL APPLICATIONS **18**

TECHNICAL CHARACTERISTICS **19**

PREVIEW

FLOSWITCH is versatile fully-programmable equipment, managing following functions:

- Automatic control of two different switch-over systems
- Logic control of pneumatic valves
- Status, measurement and alarm monitoring
- Emergency shut-off

The I/O provision includes four 4-20mA inputs, ten ON/OFF inputs and four solenoid valves; in addition, each input can be configured as status (digital), measurement (analog) or alarm with or without memory.
Each output solenoid valve can perform switch-over, logic or shut-off functions.

INSTALLATION

The housing of FLOSWITCH unit is IP 55 plastic box for wall mounting. Outside, the equipment must be protected from direct sun and rain.

Technical information concerning cabling, mounting and further details are shown in outlines at the bottom of the manual.

Earth

FLOSWITCH unit needs an earth connection to protect the circuitry from surges generated by electrical discharges coming from power and phone networks (see connection layout).

To safeguard the equipment from over-voltages and for safety reasons, the earth connection must exist always and obligatorily.

The builder denies all responsibilities for whichever damage to people and things, including equipment, due to fault of earth connection.

Backup battery

A NiCd backup accumulator, disconnected at the delivery, maintains data in memory and real time clock function during about thirty days.
Turn on the switch labeled BATTERY, located in the rear of the front panel, to connect the backup battery, before the first power-up.

KEYBOARD OPERATION

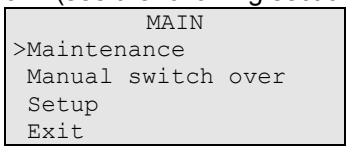
Programming, verify and command functions are performed by five keys located on the front panel, through a number of menus.

PASSWORD

Push ⇨ over two seconds: system will require the password before entering into programming mode.

Press ⇨ to select the desired character, ⇩ ⇧ to modify it, ⇦ to delete the character left.

The password authorization can be skipped by setting the keyword to blank (see the following section).



After entering the correct password, push **ACK** to confirm and open the MAIN menu, activating the programming status.

In programming mode, keys assume following functions:

⇨

- Move the cursor on the right character (editing mode only)

⇦

- Erase the left character (editing mode only)

ACK

- Execute selected command
- Open selected menu
- Open editing mode of selected parameter
- Close editing mode and accept the selected value

⇩ ⇧
- Scroll and select menus
- Select parameter values
- Increase/decrease numerical values
- Set characters during editing of alphanumerical fields

In practice, whatever editing sequence includes following steps:

1) Select desired menu or parameter using ⇩ ⇧
2) Open editing of menu or parameter, by pushing **ACK**
3) If necessary, repeat steps 1 and 2 until the desired parameter is reached
4) In editing mode
   a. press ⇩ ⇧ to select the desired option;
   b. press ⇩ to decrease, ⇧ to increase numeric values;
   c. press ⇨ to move the cursor on the character right of an alphanumeric field (after reaching the rightmost character, a further pushing of same key will move the cursor to first character left - cursor wrap-around), press ⇩ ⇧ to modify, press ⇦ to delete the character left.
5) Press **ACK** to confirm the entry and close the editing

System returns in running mode by selecting the *Exit* option from main menu, or by keyboard time-out of 60 seconds.

MAINTENANCE

Opening the MAINTENANCE menu, the status of solenoid valves can be directly controlled. Valves remain in the imposed status until the menu is leaved, then the system return in automatic running mode. Editor time-out in MAINTENANCE menu is inhibited; hence the system can be indefinitely leaved in maintenance mode.

```
   MANUAL EV DRIVE
>EV1:
ON(OFF)
 EV2:
ON(OFF)
 EV3:
ON(OFF)
 EV4:
ON(OFF)
 Exit
```

1) Select desired solenoid valve using ⇩ ⇧
2) Press **ACK** to open the editing
3) Press ⇩ ⇧ to switch the status
4) Press **ACK** to confirm and close the editing

MANUAL SWITCH OVER

The manual switch over command allows changing the current supplying bundle; effects of this command continue even after leaving the programming mode.

```
 MANUAL SWITCH OVER
Ident.          L1:
Right
Ident.          L2:
Left
Exit
```

1) Select L1 or L2 using ⇩ ⇧
2) Press **ACK** to open the editing
3) Press ⇩ ⇧ to switch the supplying bundle
4) Press **ACK** to confirm and close the editing

Note: if the switch over is not possible (for instance because of bundle exhaustion or plant shut-off status, or because a plant is not properly configured), no operation is allowed; in this case the item *no way* appears right the corresponding identifier.

PROGRAMMING

```
        SETUP
>System
 Plant
 4/20mA Inputs
 ON/OFF Inputs
 Exit
```

Select the *Setup* option from the MAIN menu and press **ACK** to open the SETUP menu.

System configuration

```
    SYSTEM CONFIG
>Buzzer Volume:
 Recovery Time:
 Relay mode:
 Language:
 Password:
 Exit
```

Buzzer volume

The variable defines the buzzer volume: valid settings are numeric values from 0 to 10; 0 corresponds to buzzer disabled.

Recovery time

This function reactivates the acoustic signal and resends the acknowledged alarm status into the unacknowledged condition, if this persists longer than the recovery time.

Valid range is from 0 to 99 minutes; (0 = recovery function disabled).

Relay mode

Following operations are available for the relay output switch:

- **CNO** *(cumulative alarm normally open)*: relay energized by alarm, shut-off and halt status
- **CNC** *(cumulative alarm normally closed)*: relay de-energized by alarm, shut-off and halt status
- **CAS** *(continuous auxiliary siren)*: relay follows the status of the internal alarm sound generator.

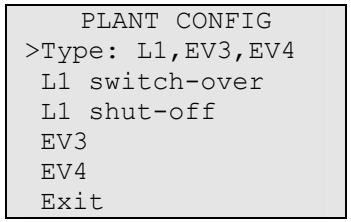
Language

Following languages are available:

- English
- Italian

Password

This option allows set or modify the keyword. The password authentication can be skipped setting the keyword to blank.



Plant configuration

The contents of this menu differ in functions of the option selected in TYPE parameter.
Two lines are related to each switch-over system, respectively for plant and shut-off configuration; only one configuration line is associated to each available solenoid valve.

Type

Define the control functions of FLOswitch.

- **EV1…4 -** All EVs for logic control or shut-off function
- **L1, EV3, EV4 -** One switch-over system, EV3 and EV4 available for logic control or shut-off function
- **L1, L2 -** Two switch over systems

```
   L1 SWITCH-OVER
>ID:
 Control:
 Priority:
 Exit
```

ID

Alphanumeric string, with maximum length 16 characters, that identifies the switch-over system. It is recommended to use same name for identifier and gas or mixture supplied by the switch over system.

Control

Devices for bundles level checking.

Select ON/OFF for switch sensors, 4/20 mA for transducers.

Priority

Bundle that supplies at first system startup and whenever the control logic has no other criteria. Select LEFT or RIGHT.

```
    EV1 CONTROL
>ID:
 Mode:
 ON by:
 Power up:
 [input list]:
 Exit
```

ID

Alphanumeric string with maximum length of 16 charters identifying the function of the solenoid valve.

Mode

Select the function associated to the solenoid valve: LOGIC or SHUT-OFF.

ON by

Logic relation, among the selected inputs, that energizes the solenoid valve.

Option “one input” energizes the solenoid valve when one or more inputs among those selected become active (logical OR function).

The option “all inputs” energizes the solenoid valve only when all selected inputs become active (logical AND function).

This entry is available only if MODE is set to LOGIC; the logic relation for the SHUT-OFF cannot be modified by user (see section SHUT-OFF).

The active input condition corresponds to:

- Close if NO, open if NC for digital inputs (ON/OFF)
- Value outside thresholds for analog inputs (4/20mA)

Power up

This entry is available only if MODE is set to SHUT-OFF and activates the shut-off function after each power up.

[input list]

Input list shows the identifiers of all enabled inputs (see INPUT SETUP menus).
Switch the field YES/NO of the corresponding input to include/exclude it from the logical or shut-off function.

```
     L1 SHUT-OFF
>Power up:
 [input list]:
 Exit
```

This menu defines the input conditions determining the switch-over system shut-off. The function is identical to that already described for a single solenoid valve.

Refer to EV CONTROL CONFIG menu for further details.

Input Setup

The menu allows defining all parameters concerning analog and digital inputs, including transmitters, sensors and functions.

```
  4/20mA INPUT SETUP
>Input 1            √
 Input 2
 Input 3            √
 Input 4
 Exit
```

The check-symbol √ indicates the corresponding input is already enabled.
Select the desired input and then press **ACK** to configure it.

```
  4/20mA IN1 CONFIG
>Enable:
 ID:
 Unit
 Zero
 Full Scale
 Tare
 Function:
 Alarm delay:
 Min alarm
 Max alarm
 Exit
```

4/20 mA INPUTS

Enable

Switch to enable or disable the input.

Identifier

Alphanumeric string, with maximum length 8 charters, defining the measurement associated to the input.

Unit

Measurement units associated to the input. Following options are available: %, Kg, ton, bar, mbar, pH.

Zero – Full Scale

Range of the transducer, defined with measurement units selected through *Unit* item.

Zero and FS values correspond to the measurements supplied by the analog transducer when the output current is respectively 4 and 20 mA.

Valid range is from -1000.0 to 1000.0 with fixed decimal point.

Tare

Weight of the cylinder empty, expressed in the selected measurement units. The field appears only when measurement units are set to *Kg* or *ton*.

Function

Function associated to the input.

MEASURE	the input does not generate ALARM status
ALARM	the active status of the input generates ALARM status
ALARM + MEM	the active status of the input sets ALARM status and this ends after the following two conditions are verified: user acknowledgement and input come back to normal status.

Alarm delay

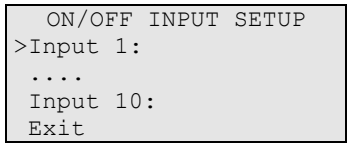
Minimum duration of the alarm condition (signal outside alarm thresholds) before generating the alarm status, expressed in seconds.

Valid values range from 0 to 99 seconds.

Min – Max alarm

Minimum and maximum alarms thresholds.

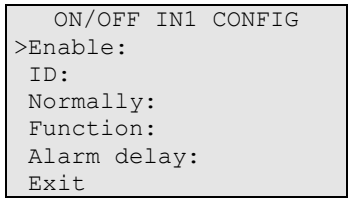
Values must be set within the interval Zero – FS and so that *Max* is greater than *Min*.



ON/OFF INPUTS

This page is similar to the ANALOG INPUT SETUP PAGE, but refers to digital inputs instead of analog inputs.

Select the desired input and press **ACK** to open its configuration page.



Normally

Normal status of the input, corresponding to OFF and/or non-alarm condition. Set *NO* for normally open, *NC* for normally closed.

For remaining fields, refer to previous section *4/20mA inputs configuration*.

ERASING SETUP PARAMETERS

Setup parameters are stored in a non-volatile memory and retained also in power-off condition, without time limits.

All current setup parameters can be erased and set to default values by pressing the pushbutton behind the front panel, close to the battery switch.

FUNCTIONS

Monitoring

In absence of alarm or shut-off status, the display shows monitoring pages, containing up to four measurements and/or states.

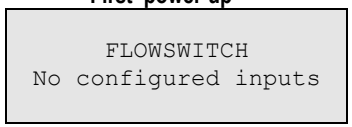
In case the number of signals exceeds four, the display will show more monitoring pages in sequence, alternating them each 5 seconds.

The monitoring criterion consists of minimizing the number of pages, by filling the display as far as possible.

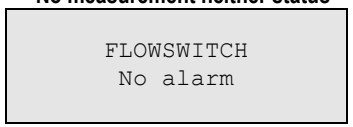
For example, configuring only one analog and tree digital signals, only one monitoring page will suffice for all information.

Some typical monitoring pages are shown below.

First power-up



No measurement neither status



Measurements only

```
ID An.1   value 1 un1
ID An.2   value 2 un2
ID An.3   value 3 un3
ID An.4   value 4 un4
```

Measurements and states

```
ID An.1   value 1 un1
ID An.2   value 2 un2
ID Dig.1     status1
ID Dig.2     status2
```

Where the meaning of *identifier* and *measurement unit* (*un*) was still explained in previous section *programming*, and *value* indicates the current value of the measurement, expressed in units *un*.

The field *status* indicates the current status of the corresponding sensor, as shown in following table.

Sensor status	Input normal status	***Status***
Open	Normally open	**OFF**
Close	Normally open	**ON**
Open	Normally close	**ON**
Close	Normally close	**OFF**

Alarms management

Alarm page management differs from monitoring of status pages due to following details:

- When an alarm status is asserted, the display suspends the cyclical visualization of status pages and shows a blinking page containing alarm information (alarm page), until the acknowledgement operation; After the acknowledgement, the display restarts the standard functions and the blinking alarm page follows the status pages;
- Alarm lines associated to digital inputs contain the ID of the corresponding input
- Alarm lines associated to analog inputs contain the suffix MIN or MAX, depending on the current measurement value respect to alarm thresholds, followed by the ID of the corresponding input;
- Alarm pages disappear after the end of all alarm events, namely: when all inputs classified as alarm without memory return in normal status, all inputs classified as alarm with memory return in normal status and are acknowledged.

The **acknowledgement** of the current alarm page, appearing on display, occurs by pushing the **ACK** pushbutton on front panel.

If more than four alarms are asserted, the corresponding ID will appear on more pages, each requiring a distinct **ACK**; in this case, the display will resume the standard functions after acknowledging all alarm page.

In case a new alarm goes active when all current alarm pages are acknowledged, the display stops on alarm page showing new information.

Whichever acknowledged alarm status persisting longer than the ***recovery time*** automatically returns into the unacknowledged condition and requires a new acknowledgement sequence.

The **acoustic signal** continues until unacknowledged alarm pages exist.

The **red light signal** testifies the alarm status.

Typical ALARM PAGE

```
Min ID An1
Max ID An3
ID Dig 7
```

This example shows an Alarm Page including tree alarms by analog transmitter and switch sensors.

Fails

FLOSWITCH periodically performs a self-test to recognize possible fails.

The system fails are classified and monitored as alarms, and include:

Fail message or signal	Fail origin	Effects
`Sensors power fault`	Onboard auxiliary power supply	All inputs out of order
`Valves power fault`	24Vdc auxiliary power supply	Solenoid valves out of order
`ID1…4 --- un`	Transmitter 1…4 disconnected	Signal out of range
`Slow blinking of fault red led`	Electronic system	System fault

When a transmitter is disconnected also the corresponding monitoring page shows following line: `ID1…4 --- un`

Shut-off

The shut-off function can be associated to a solenoid valve or to a switch-over system, and de-energizes the solenoid valve or both solenoid valves driving a switch-over system when one or more inputs included in the shut-off equation become active.

The *Shut-off status* is an event with memory, therefore it begins when the corresponding equation becomes true and ends when both the following conditions are satisfied:

- Shut-off equation is false (all shut-off events are terminated)
- Shut-off status is acknowledged

The shut-off status is always followed by the *Halt status*, thus the solenoid valves remains de-energized until the user restart.

The shut-off is managed like an alarm with memory and notified on display by the alarm line EMO ID, where ID identifies the corresponding solenoid valve or switch-over system in shut-off status.

Halt

The *Halt status* always occurs after the *Shut-off* and is testified by the **yellow light signal** blinking.

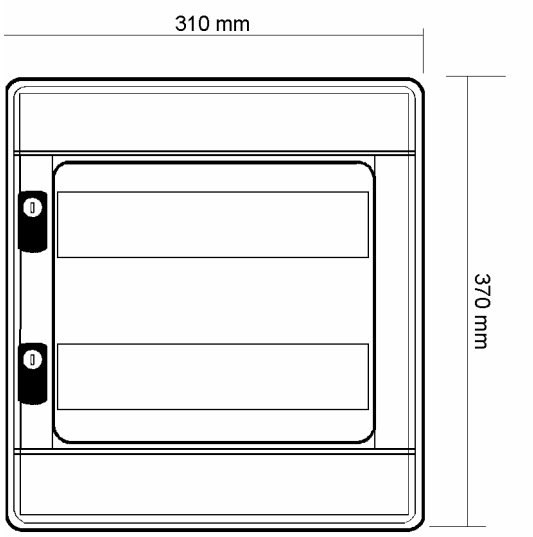
```
ID HALTED

PRESS ACK TO RESTART
```

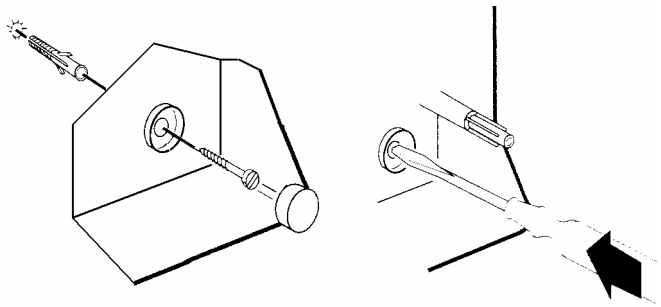
During the *Halt status* the involved solenoid valves stand close from previous *Halt Status*, the display suspends the scrolling functions and shows the message left, where ID identifies the corresponding solenoid valve or switch-over system.
In case more halt states occur simultaneously, the halt page corresponding to the desired plant can be selected using ⇩ ⇧ and the selected plant can be restarted it pressing **ACK**.

From the Halt status the user can directly enter the programming mode and perform manual operations through the MAINTENANCE menu before restarting a specific plant.

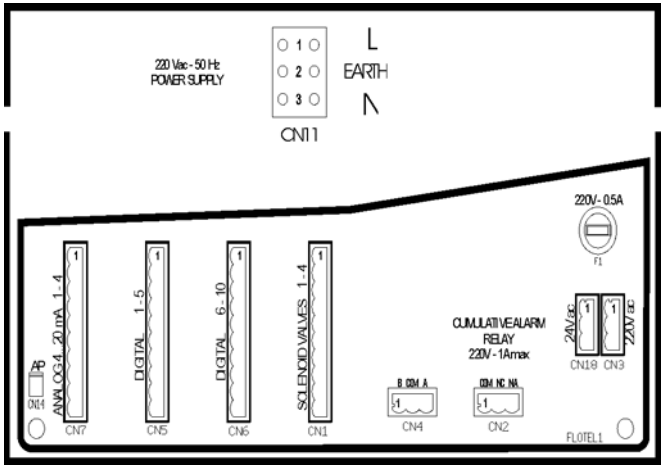
MOUNTING



Mounting tools # 4 Ø 6 mm expansion nails
Drilling layout 220 mm X 160 mm



ELECTRICAL CONNECTIONS



CN7 4…20 mA analog inputs
CN5 Digital inputs from 1 to 5
CN6 Digital inputs from 6 to 10
CN1 Solenoid valves control
CN2 outputs alarm relay
CN11 220Vac power supply

CN7
Analogs 4...20 mA

Pin	Input
1	+ AN 1
2	– AN 1
3	+ AN 2
4	– AN 2
5	+ AN 3
6	– AN 3
7	+ AN 4
8	– AN 4
9	COM -
10	ground

CN5
Digitals 1– 5

Pin	Input
1	+ D 1
2	– D 1
3	+ D 2
4	– D 2
5	+ D 3
6	– D 3
7	+ D 4
8	– D 4
9	+ D 5
10	– D 5

CN6
Digitals 6– 10

Pin	Input
1	+ D 6
2	– D 6
3	+ D 7
4	– D 7
5	+ D 8
6	– D 8
7	+ D 9
8	– D 9
9	+ D 10
10	– D 10

CN1
Solenoid valve controls

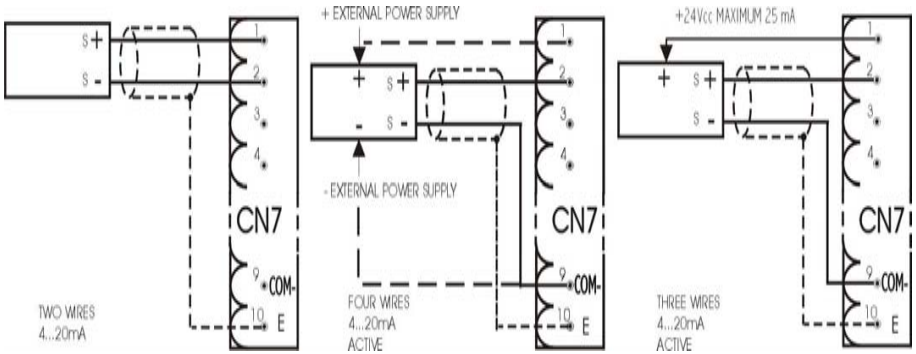
Pin	Signal	Type
1	V 1 (+)	OUT
2	V 2 (+)	OUT
3	V 3 (+)	OUT
4	V 4 (+)	OUT
5	*reserved*	--
6	*reserved*	--
7	24 V (+)	IN
8	24 V (+)	IN
9	24 V (–)	IN
10	*reserved*	- - -

CN2
Relay output

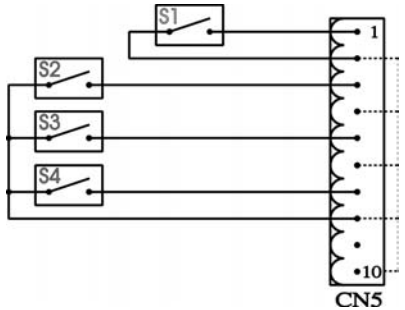
Pin	Output
1	COM
2	NC
3	NO

TYPICAL APPLICATIONS

ANALOG SENSORS



DIGITAL SWITCH SENSORS



Warning ! !

- Pins 2 – 4 – 6 – 8 – 10 of screw connectors CN5 e CN6, labeled by**– D**, are interconnected on FLOSWITCH board.
- Do not connect external power supplies switch sensors

TECHNICAL CHARACTERISTICS

FLOSWITCH

4…20 mA Analog Inputs	
Compatibility	4...20 mA transmitters
Maximum voltage (open circuit)	24 Vdc
Minimum voltage @ I = 20 mA	16 Vdc
Short circuit current	25 mA
Resolution	10 bit
Digital Inputs	
Compatibility	Switch sensors
Maximum voltage (open circuit)	15 Vdc
Short circuit current	15 mA
Alarm relay output	
Maximum switching voltage	250 Vac / Vdc
Maximum switching current	100 mA
Power supply	
Supply voltage	220 Vac – 50 Hz
Maximum supply current	100 mA
Solenoid valves	
Power supply	24 Vdc, 2 VA
Maximum operating pressure	10 bar
Compatibility	Inert gases
Mechanical protection degree	IP 55